U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NEW YORK CONSERVATION PRACTICE GUIDELINE

UNDERGROUND OUTLET

(FEET)

CODE 620

REFERENCE

National Handbook of Conservation Practices – Standard Code 620

Commonly Associated Practices or Processes

The following conservation practices are commonly used in conjunction with this practice to address natural resource concerns and opportunities in New York. This does not imply that any or all of the listed practices must be included or that others may not be included in a conservation management system (CMS). Consult Section III of the Field Office Technical Guide for assistance in developing CMS.

Note: To determine whether a National or New York Conservation Standard applies to this and any other associated practices, check the following website: www.ny.nrcs.usda.gov. Click on the Technical Resources button, and look in the left-hand column for "eFOTG" on the next screen. Next, click on the "eFOTG" link, and look for the Conservation Standards in Section IV.

Table A: Commonly Associated Processes or Practices

Number	Name	Job/Engineering Sheets
362	Diversion	NY ENG 22 and 23
NY393a	Filter Strip — Area	
412	Grassed Waterway	NY ENG 24 and 25, and/or 24A and 25A
468	Lined Waterway or Outlet	
558	Roof Runoff Structure	
574	Spring Development	
606	Subsurface Drain	NY ENG 28 and 29
607	Surface Drain – Field Ditch	
608	Surface Drain – Main or Lateral	
638	Water and Sediment Control Basin	
NY707	Barnyard Water Management System	
EFH-2	Estimating Runoff	NY ENG 20 Wrkshts 1 & 2

Other References

Engineering Field Handbook – Chapter 1-Engineering Surveys, Chapter 2-Estimating Runoff and Peak Discharges, Chapter 3-Hydraulics, Chapter 8-Terrace, Chapter 11-Ponds and Reservoirs, Chapter 14, Drainage.

NRCS-NY
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New York Drainage Guide, September 1987.

Current Soil Survey Data

Urban Hydrology for Small Watersheds, TR-55.

CULTURAL RESOURCES

Cultural resource reviews will be conducted for all ground disturbing practices, components, or other activities, as per the State Level Agreement between NRCS and the New York State Historic Preservation Officer.

PERMITS AND NOTIFICATIONS

All permits, easements, and rights-of-way are the responsibility of the landowner. **Dig Safely NY** (formerly the Underground Facilities Protection Organization, or UFPO) and non-member local utilities will be contacted according to the time required before construction to mark all applicable facilities in the construction area. This is the responsibility of the excavator.

Identification and the location of all other farmstead underground or overhead facilities is the responsibility of the landowner.

INVENTORY AND EVALUATION

1. Determine the need for underground outlet(s) during evaluation of associated practices. Examples include low flow structures in a grassed waterway, underground outlet terrace/diversion, and underground outlets for roof water runoff management.
2. Locate a suitable outlet(s) considering stability, safety, and property rights. Consider the potential for transport of nutrients and other contaminants to the receiving outlet location or water body. Also consider this in the siting of surface/blind inlet location(s), and conduit location(s) and type.
3. Review the current soil survey information and evaluate the feasibility for installation. Obtain soil borings or test pits along the conduit location as necessary.
4. Survey the proposed underground outlet centerline noting grade changes, and include proposed locations of surface inlet(s) and outlet(s).
5. Investigate the drainage area(s) for each of the surface inlet(s) and determine drainage areas, land use and cover type conditions for computation of the peak flow. If base flow conditions are a concern, physically collect a series of representative volume measurements to estimate base flow rate.

DESIGN PROCEDURE

Case A – When the underground outlet is designed to address only base or low flow, while the associated practices (e.g. diversion, terrace, waterway) are designed to handle the peak discharge from the design storm.

1. Determine the low flow discharge (cfs) to each surface inlet using the drainage area size and EFH, Chapter 14-66 and 14-67, or the NY Drainage Guide, pages 43-44. Consider the size of drainage area and use the 1-inch drainage coefficient off the drainage area to determine low flow. For base flow, estimate discharge by physical measurements taken on-site.

2. Using the collected survey data, plot the centerline profile of the underground outlet, and establish grades and depths for the conduit. Use the minimum grade along the profile line and low flow discharge (cfs) to determine conduit type and size to be used. Conduit should not exceed 75% capacity to avoid a pressure flow condition. CPDT (corrugated plastic drainage tubing) is the most common drain pipe material and practical sizes range from 4 to 8 inches.
3. Establish elevations for the inlet structures and orifice plates or other flow control devices, as required. Establish the maximum water surface elevation at the inlet at the design depth when associated practices are operating at design capacity. Using the basic weir formula (EFH Chapter 3, page 3-50, Eq. 3-21), determine the low flow discharge, and maximum head above the weir of the surface inlet to determine the size of the surface inlet.
4. Subtract the orifice elevation from the maximum flow elevation, to determine the maximum head on the orifice. Using the maximum head and the low flow discharge, determine the orifice size. Use EFH Chapter 8, exhibit 8-5, or appropriate hydraulic equations.

Case B – When the underground outlet handles the entire peak discharge from the contributing drainage area (such as a roof runoff system).

1. Estimate the peak discharge for the design storm by completing Worksheets 1 and 2 of Chapter 2 of EFH.
2. Establish elevations and gradients of the conduit, inlet structures, and flow control devices on the plotted profile. Establish maximum water surface elevation at the inlet.
3. Size orifice (or other device) to provide capacity equal to the design peak discharge. Use EFH Chapter 8, Exhibit 8-5, or appropriate hydraulic equations. Design head will be maximum water surface elevation minus the orifice plate elevation.
4. Subtract the elevation of the top of the surface inlet (weir) from the elevation of the maximum water surface at the inlet, to determine the head on the weir. Using the head and the peak discharge, determine the surface inlet size using the weir formula in EFH Chapter 3, page 3-50, Equation 3-21.
5. Select conduit type and size to carry the peak discharge without flowing full. Use drain capacity charts or other appropriate procedures. Refer to EFH, Chapter 14-66 and 14-67, or the NY Drainage Guide, pages 43-44. Conduit should not exceed 75% capacity to avoid a pressure flow condition.

Case C – When the runoff from the design storm is controlled by a combination of (a) temporary storage in a diversion or other structure, and (b) discharge through an underground outlet. Design for this case requires a flood routing procedure. This procedure follows EFH, Chapter 8, pages 8-101, 8-102.

1. Establish ridge and channel profiles and design cross-sections for the diversion (or other structure) at the inlet location. Set design high water using ridge elevation and appropriate freeboard.
2. Determine the drainage area in acres and runoff curve number for that drainage area at the surface inlet. Determine the 24 hour rainfall and runoff (in inches) for the desired storm frequency.
3. Determine the volume of temporary storage in watershed inches. Calculate temporary storage at design high water elevation in acre-feet and convert to watershed inches by dividing the temporary storage volume by the drainage area in acres and multiplying by 12 inches/foot.

4. Using the routing chart, EFH, Chapter 11, page 11-68, Exhibit 11-9, enter chart with the inches of runoff and inches of storage to determine the resulting release rate in cfs per acre. Compute the outflow discharge, Q_o in cfs, by multiplying the release rate (in cfs per acre) by the drainage area in acres.
5. Plot the profile of the outlet conduit and determine the minimum grade of the conduit, and establish the elevation for orifice flow control plate.
6. Size the orifice to pass the outflow discharge, Q_o, at average discharge head. Average discharge head can be determined as shown on page 8-71 of the EFH. Using the outflow discharge and average head, enter exhibit 8-5, page 8-102 of the EFH, and obtain orifice size.
7. Using the orifice size and maximum head on the orifice, determine the maximum outflow discharge, Q_m. Maximum head on the orifice is the ridge elevation minus the orifice plate elevation.
8. Using the maximum outflow discharge, Q_m, and the minimum grade of the conduit, determined in step 5, determine the conduit size needed from the appropriate exhibit 14-34 or 14-35, pages 14-66 or 14-67 of the EFH.
9. If the conduit size is too large or too small, raise or lower the ridge height and repeat steps 1-8 until a satisfactory design is obtained.
10. Efficient design will be achieved by repeating the process to obtain a practical balance between earthwork volumes and conduit dimensions.

All Cases:

1. Check that the conduit type and size is adequate to handle all flows from surface inlets and from existing or planned subsurface drainage systems. Check conduit bedding, blinding and depth of cover over pipe to determine that adequate protection is assured for the system.
2. Check to insure that the combination of all orifice flows at maximum head do not exceed 75% capacity of the underground outlet conduit.
3. Compile all design information in appropriate design folder.
4. Develop construction drawings and specifications for underground outlet project, locate and describe all visible public utilities near the project. Include profile showing conduit size, material, gradients, required and actual capacities, inlet locations, and orifice elevations. Show structural details of surface inlets and flow control devices showing material, dimensions, and elevations. Include conduit outlet details including outlet pipe, headwall requirements, and swing type-animal guard.
5. Compute material quantities, such as trenching, backfill, type and length of pipe (for each of the designed sizes) and for any other appurtenances.
6. Develop a cost estimate, an O & M Plan, and an inspection plan for the project, and review these and the completed construction drawings and specifications with the landowner.
7. A statement requiring the excavator to notify **Dig Safely NY** and non-member utilities for proper utility notification is **REQUIRED** on the drawing.
8. Determine your level of Job Approval Authority for the design class of this project, obtain approval from appropriate individual, if not qualified.
9. Assemble a complete final construction package.

PRE-CONSTRUCTION ACTIVITIES

1. Provide copies of the construction specifications and drawings to the landowner. Explain all aspects of the job before a contractor is secured. Review the O&M plan with the landowner to assure proper maintenance of the completed practice.
2. Thoroughly review the job with the landowner and contractor prior to construction. Insure that all utilities applicable to the job site have been notified and are marked prior to construction.
3. Schedule the construction start with the landowner and contractor. Coordination of all staking and construction timing with the contractor and landowner can assure an efficient use of manpower.
4. Mark the centerline stations with proposed cuts, set and mark offset grade stakes if needed. Set stakes at surface inlet locations to show orifice elevations, any other critical elevations.

CONSTRUCTION INSPECTION

Make random construction checks during implementation. The checks should include:

- Surface inlet(s) size and material, orifice size(s), and conduit materials and sizes; and other appurtenances, as required; and,
- Adherence to the design grade, bedding/blinding, and depth/cover; and,
- Elevation for the top of surface inlet(s), orifice plate(s), and maximum head.

During the final construction check, assure that the:

- Installed outlet(s) (as applicable) are stable and free of spoil and debris; and,
- Animal guard(s) are properly installed and secured; and,
- Trench is adequately backfilled to allow for settlement; and,
- Construction spoil and debris are properly disposed of.

Document the progress of the construction in the Cooperator Assistance Notes (NRCS-CPA-6/6A) or a similar job log. In addition, photographs documenting construction progress are useful, although not required.

FINAL DOCUMENTATION REQUIREMENTS

All properly planned, designed, and installed conservation practices require documentation in the appropriate case file. Documentation must be sufficient to show:

1. The design conforms to the applicable standard;
2. The prepared construction drawings and specifications accurately reflect the design;
3. The installed practice meets the requirements of the construction drawings and specifications; And,
4. The documented drawings are to be marked "As Built", with changes shown in red.

REPORTING

Enter all documentation on the Conservation Plan (NRCS-CPA-68), Conservation Assistance Notes (NRCS-CPA-6/6A) and the contract document (NRCS-LTP-11), if applicable.

Report the practice and applicable components in the NRCS progress reporting system. Be certain to report benefits for all applicable resources and resource concerns as allowed in the NRCS progress reporting system.

OPERATION AND MAINTENANCE

Facilities, structure, and practices must be operated and maintained to ensure proper function and longevity. Periodic follow-up with the landowner is essential to ensure that all operation and maintenance (O&M) requirements are understood and followed.